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AN ANALYSIS OF THE IMPACT ON THE ELECTRIC UTILITY INDUSTRY OF ALTERNATIVE APPROACHES TO SIGNIFICANT DETERIORATION. VOLUME I: EXECUTIVE SUMMARY

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An Analysis of the Impact on the Electric Utility Industry of Alternative Approaches to Significant Deterioration

by

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and

Federal Energy Administration

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16. Abstracts

This report is a summary volume of a two-volume study which evaluates the impact of proposed Senate, House, and EPA regulations regarding significant deterioration of air quality on the electric utility industry. The following issues are evaluated: aggregate impact of significant deterioration requirements on new coal-fired power plants; implications of Class I area designations; impact of alternative Class II increments; implications of stack height limitations; and minimum degree of emission control. The study methodology and findings of the analysis are summarized, as are the limitations of the study. The project also provided principal areas of possible future work.

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PREFACE

This report was prepared jointly by the the Environmental Protection Agency (EPA) and the Federal Energy Administration (FEA). EPA and FEA gratefully acknowledge the assistance and support of the U. S. Geological Survey of the Department of Interior, which compiled and printed the maps contained herein.

Neither the cartographic information, nor the contents of this report, necessarily reflect the views or policies of either the U. S. Geological Survey or the Department of Interior.

This report was prepared in two parts. Volume II, Technical Support Document, is available upon request from the Public Affairs Office of either EPA or FEA. Also available upon request are large (19" x 28") versions of the maps enclosed herein and contained in the Technical Support Document.

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Volume I: EXECUTIVE SUMMARY

I. INTRODUCTION AND CONCLUSIONS

A. Introduction

In 1972, the Sierra Club and other environmental groups filed suit against EPA for failure to promulgate regulations under the Clean Air Act to prevent the significant deterioration of air quality. Both the District Court of the District of Columbia and the U.S. Court of Appeals for the District of Columbia Circuit granted the Sierra Club's motion and required EPA to promulgate significant deterioration regulations. In June 1973, the Supreme Court, by a four-to-four vote, affirmed the judgment of the Court of Appeals.

After extensive public participation and technical and economic analyses, EPA published final regulations in December 1974 1/, which are based on allowable increments of pollutant concentrations for specific categories of new major industrial sources under an area classification procedure. Subsequently, the Administration, as part of the Energy Independence Act of 1975, requested Congress to consider legislation which would clarify Congressional intent on the prevention of significant deterioration of air quality. The Administration requested that Congress carefully examine the potential effects of a significant deterioration policy, including the consideration of its complete elimination as well as other alternative approaches. In addition, Congress was asked to provide explicit guidance that would allow a balancing of environmental, economic, and energy concerns in any legislative determination of the significant deterioration issue.

In the course of debate on the significant deterioration issue, both the Senate and House subcommittees have proposed plans 2/ which, although similar in many respects to EPA's promulgated regulations, appear to have different impacts, especially on new coal-fired power plants.

This report has been jointly prepared by the Environmental Protection Agency and the Federal Energy Administration. The analysis investigates the possible impacts of the EPA, Senate, and House significant deterioration

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1/ See Significant Deterioration Regulations Published (40 CFR Part 52), 39 FR 42510; December 16, 1974.

2/ Senate discussion draft of September 8, 1975.
House Discussion draft of June 16, 1975, as amended by Congressman Heinz's Amendments on September 4, 1975.

approaches on the electric utility industry. It should be noted that this paper does not address: (1) the impact of alternative significant deterioration proposals on other industrial facilities such as petroleum refineries, synthetic fuel plants, steel mills, and non-ferrous smelters; and (2) the economic/energy costs and benefits that would result from preventing the degradation of air quality up to the national secondary ambient air quality standards.

The analysis is preliminary, but nonetheless, indicative of the range of impacts that could result from alternative significant deterioration approaches.

B. Conclusions

The major conclusions of the study are:

- The aggregate impact of the Senate and House significant deterioration proposals would not prevent the construction of new coal-fired power plants. However, the Congressional proposals would require most new coal-fired plants to either meet emission limitations more stringent than Federal New Source Performance Standards (NSPS), construct taller stacks, build smaller plants and/or relocate at alternative sites.1/2/

- The number of Federal land areas that are designated Class I, as compared to the Class II and III requirements has the greatest impact on (1) the siting and size of new coal-fired power plants,and (2) the level of pollution control required for new coal-fired plants. This results from the fact that new coal-fired plants must be located at a sufficent distance from the Class I area in order to prevent the plant's emissions from violating the Class I increment.

- The impact of the Class I increment is not uniform by geographical area. In addition, the areas impacted by Class I designations may affect the availability of water resources (inland or coastal) that will be needed for power plant cooling.

1/ It was not possible to estimate the aggregate impact of EPA's significant deterioration regulations because the decision to maintain the Class II designation or redesignate to Class I or III is at the discretion of State and local authorities.

2/ Note, however, the Senate proposal independently requires the use of best available control technology (BACT) on a case-by-case basis which in many instances may require a power plant to meet emission limitations more stringent than NSPS.

- A 1000 MW coal-fired power plant meeting NSPS could be built in areas of flat terrain (i.e., surrounding terrain at or below the top of the plant's stack) under the EPA/Senate and House Class II increments.

- In areas of non-flat terrain, a 1000 MW plant meeting NSPS could not comply with the EPA/Senate Class II increment if surrounding terrain within 15 miles is at least 500 feet above the top of the plant's stack. If a plant controls beyond NSPS by the use of low sulfur coal and a scrubber, a plant could comply with the EPA/Senate Class II increment unless the surrounding terrain within 3 miles was at least 500 feet above the top of the plant's stack. It should be noted, however, that a 1000 MW plant located in areas of non-flat terrain would, in certain circumstances, be unable to comply with national ambient air quality standards.

- The House Class II increment is more restrictive than the EPA/Senate Class II increment on the siting and size of new coal-fired power plants because the House 3-hour limit for sulfur dioxide is approximately 50% of the EPA/Senate increment.

- Increasing the allowable stack height from 500 to 1000 feet and/or meeting emission limitations more stringent than NSPS significantly reduces the probability that a plant may be affected by Class II increments in areas of non-flat terrain.

- The ability to redesignate a Class II area to a Class III area (i.e., as in the House and EPA proposals) provides the flexibility to allow the siting of large coal-fired plants in areas of non-flat terrain. However, since the House Class III increment is approximately 50% of the EPA Class III increment, there is less flexibility under the House proposal.

II. ALTERNATIVE SIGNIFICANT DETERIORATION APPROACHES

The general approach to "significant deterioration" taken by EPA and by the Congressional Subcommittees is similar, although numeric limits and coverage vary considerably. In all cases, significant deterioration is prevented by establishing a specified pollution increment in terms of ambient air quality concentrations which may not be exceeded by any major new source of combination of major new sources. In addition, each plan calls for the establishment of area classifications designed to correspond to the overall land use intended for the area, and to reflect the amount of energy or industrial growth desired. These "classes" were established by the EPA regulations as follows:

- Class I - Applies to areas in which practically any air quality deterioration would be considered significant, thus allowing little or no major energy or industrial development.

- Class II- Applies to areas in which deterioration that would normally accompany moderate, well-controlled growth would not be considered significant.

- Class III-Applies to areas in which deterioration would be permitted to allow concentrated or very large scale energy or industrial development, as long as the national secondary ambient air quality standards are not exceeded.

A critical aspect of the EPA regulations is that all regions are initially designated as Class II, subject to redesignation as Class I or Class III by initiative at the State and local level. EPA anticipated that Class I designations would be made to protect existing clean air resources in areas such as national parks and wilderness areas, and the Class III redesignations would occur where State or local policies called for extensive industrial development, requiring incremental air quality increases up to the national ambient air quality standards. To date, no known formal application has been made by communities, States or Federal land managers to reclassify regions to the Class I or Class III designations.

As indicated in Table 1, the Senate numerical limits for Class I and II areas are the same as EPA's. However, the Senate approach has several substantial differences:

TABLE 1: ALLOWABLE AIR QUALITY INCREMENTS UNDER ALTERNATIVE SIGNIFICANT DETERIORATION PROPOSALS
(ug/m^3)

Pollutant Standard	CLASS I EPA Regs.	CLASS I Senate Proposal	CLASS I House Proposal 1/	CLASS II EPA Regs.	CLASS II Senate Proposal	CLASS II House Proposal 1/	CLASS III EPA Regs. 2/	CLASS III Senate Proposal	CLASS III House Proposal
Sulfur Dioxide									
Annual	2	2	1.6	15	15	20	80	No Class III	40
24-hour	5	5	7.3	100	100	91	365		183
3-hour	25	25	26	700	700	325	1300		650
Total Suspended Particulates									
Annual	5	5	7.5	10	10	19	75	No Class III	38
24-hour	10	10	15	30	30	38	150		75

1/ The increments for the House proposal are based on limitations of 2% of NAAQS for Class I, 25% for Class II, and 50% for Class III, except that the limit for total suspended particulates in Class I is 10% of NAAQS. In addition, the House proposal stipulates that the concentration of all pollutants cannot exceed 75% of the national ambient air quality standards in any of the classes.

2/ EPA's Class III allows degradation up to the NAAQS:

	Sulfur Dioxide	TSP
Annual	80 (primary)	75 (primary)
24-hour*	365 (primary)	150* (secondary)
3-hour*	1300 (secondary)	

* The 24-hour and 3-hour standards are not to be exceeded more than once per year. There are no primary 3-hour standards for sulfur dioxide and particulates, nor is there a 24-hour primary standard for particulates.

- The Senate version eliminates Class III designations.
- The Senate requires the designation of some areas of national importance as mandatory Class I and other areas as Class I unless they are redesignated by agreement between the States and the Federal government. (See Table 2).

The House also adopts the EPA approach but contains the following differences:

- The House has more mandatory Class I designations than the Senate (see Table 2).
- The House, like EPA, has a Class III but the allowed increment is half EPA's increment. In addition, a general air quality ceiling of three-fourths of the national ambient air quality standards is imposed.
- The House version includes different numerical limits for the Class I and II increments, but the only significant difference is that the three-hour sulfur dioxide Class II increment is less than half of the EPA and Senate Class II increments (see Table 1).

The other important differences among the proposals are summarized in Table 3. One of these is related to the control technology a new power plant must install regardless of the applicable air quality increment. While EPA's significant deterioration regulations require compliance with New Source Performance Standards (NSPS) or State regulations where they are more stringent than NSPS, the Senate requires the maximum degree of control technology achievable as determined on a case-by-case basis. The Senate proposal may, therefore, require installation of flue gas desulfurization systems (i.e., scrubbers) with low sulfur coal, whereas EPA's significant deterioration regulations do not unless it is required by State law or necessary to meet the applicable air quality increments.

Another important difference is that the House version provides for limitations on the allowable stack height for new power plants.

TABLE 2

CLASS I AREAS UNDER SENATE AND HOUSE APPROACHES TO SIGNIFICANT DETERIORATION

Land Category	Senate	House
· International Parks (if 1,000+ acres)	Mandatory Class I	Mandatory Class I
· National Parks (if 1,000+ acres)	Mandatory Class I	Mandatory Class I
· National Wilderness Areas (if 1,000+ acres)	Mandatory Class I	Mandatory Class I
· National Wildlife Refuges (if 1,000+ acres)	Mandatory Class I	Mandatory Class I
· National Monuments	Class I; Provision for redesignation as Class II	Mandatory Class I (if 1,000+ acres)
· National Preserves	Class II;Provision for redesignation as Class I	Mandatory Class I (if 1,000+ acres)
· National Recreational Areas	Class I; Provision for redesignation as Class II	Class II; Provision for redesignation as Class I or Class III
· Wild and Scenic Rivers	Class I; Provision for redesignation as Class II	Class II; Provision for redesignation as Class I
· National Lakeshores and Seashores	Class I; Provision for redesignation as Class II	Class II; Provision for redesignation as Class I
· National Forests	Class II;Provision for redesignation as Class I	Class II; Provision for redesignation as Class I
· Military Reservations	Class II;Provision for redesignation as Class I	Class II; Provision for redesignation as Class I or Class III
· Other Federal Lands	Class II;Provision for redesignation as Class I	Class II; Provision for redesignation as Class I or Class III

TABLE 3

SUMMARY OF MAJOR DIFFERENCES OF ALTERNATIVE APPROACHES TO SIGNIFICANT DETERIORATION

Issues	EPA	House	Senate
Sources Covered	18 source categories	Any facility emitting more than 100 tons/yr. of any regulated pollutant	Major emitting facility
Pollutants Covered	TSP and SO_2	All	TSP, SO_2, others to be established later
Control Technology Requirements	Equivalent to NSPS where NSPS exist; and determined on a case-by-case basis where NSPS does not exist	None specified	Maximum degree of emission control possible; determined on a case-by-case basis
Class I Areas	No mandatory (at state and Federal discretion with procedures for full public participation)	Designation of some areas as mandatory Class I and others as either Class I, II or III (see Table 2)	Designation of some areas as mandatory Class I and others as either Class I or Class II (see Table 2)
Class III Areas	Procedures for designation of areas as Class III	Procedures for designation of areas as Class III	No Provision for Class III
Numeric Limitations for Class I,II & III	See Table 1	See Table 1	See Table 1
Maximum Allowed Concentration	National Ambient Air Quality Standards Standards (NAAQS)	Three-fourths of National Ambient Air Quality Standards	National Ambient Air Quality Standards

III. ISSUES EVALUATED

A number of issues have been raised as a result of the recent legislative proposals that have been proposed by the Congress. The issues addressed in this analysis are as follows:

Issue #1: Aggregate Impact of Significant Deterioration Requirements on New Coal-Fired Power Plants

The first critical issue is the potential impact of Class I, II and III significant deterioration requirements on (1) the siting and size of new coal-fired plants and (2) the pollution control technology required for new coal-fired plants. It should be noted that the issue is not whether or not new coal-fired plants can be built, but rather what degree of emission control would be required and what restrictions would be placed on the location and size of new coal-fired plants. Therefore, the public policy issue is: the balancing of the economic, energy and related environmental consequences of alternative significant deterioration proposals against the benefits that would result from preventing the degradation of air quality up to the secondary ambient air quality standards.

Issue #2: Implications of Class I Area Designations

The designation of Class I areas is an issue because of the attendant areas of the country where power plant development may be affected. Class I areas have a significance beyond their geographic limits because the air quality increments that must be met within such areas can be violated, under certain circumstances, by large coal-fired power plants located some distance from a Class I area. The distance may range from less than 10 miles or up to 100 miles depending upon such factors as: plant size; the degree of emission control; neighboring terrain; and meteorological conditions. Therefore, the actual impact of Class I area designations on the siting and size of new power plants would affect an area much larger than the designated Class I area itself.

Issue #3: Impact of Alternative Class II Increments

Alternative Class II increments are an issue because of the resulting impact on plant size, location and required degree of emission control. Of particular importance is the impact of Class II increment on plants sited in areas of non-flat terrain.

Issue #4: Implications of Stack Height Limitations

Allowable stack height is important because a taller stack permits more diffusion of a power plant's emissions. Accordingly, restrictions by the Class II increment on the siting of power plants in areas of non-flat terrain could be minimized by the construction of taller stacks. Thus, for any assumed level of emission control, the use of taller stacks would allow the siting of larger plants. However, it should be noted that the use of tall stacks will result in greater emissions as compared to the use of scrubbers.

Issue #5: Minimum Degree of Emission Control

The last critical issue addressed in this report is the minimum degree of emission control required for new plants (i.e., the definition of best available control technology--BACT). The most restrictive limitation would be to require all plants to meet emission limitations more stringent than Federal New Source Performance Standards (NSPS) through the installation of flue gas desulfurization systems (i.e., scrubbers). The least restrictive limitation would be to require all new plants to meet NSPS or State regulations where they are more stringent than NSPS and allow the plant to choose the most cost-effective means of compliance (i.e., low sulfur coal or scrubbers) with the deterioration increments. It should be noted, however, that under either minimum requirement, new power plants would have to install whatever control technology that was required in order to comply with the applicable air quality increment (i.e., Class I, II, or III). Thus, the determination of the minimum level of emission control is only a relevant issue where more stringent emission controls than necessary to meet the applicable significant deterioration increments would be required.

IV. STUDY METHODOLOGY

The approach taken herein has been to quantitatively assess, under two analytical approaches, the incremental impacts that could result from the application of alternative significant deterioration requirements on the electric utility industry.

A. Cartographic Analysis

In the first approach, cartographic procedures were utilized to identify the potential Class I areas and to graphically depict land areas that may, under various assumptions concerning the level of pollution control, be precluded from the siting of generic 1000 MW power plants. Lands, under the Congressional proposals, that shall or may be designated as Class I have been identified in this report as follows:

- Mandatory Class I: Federal lands legislatively determined to be Class I.
- Discretionary Class I: Federal lands that under the Senate proposal are designated as Class I but may be redesignated as Class II; under the House proposal, lands that are designated Class II but may be redesignated as Class I.
- Possible Class I: Federal lands that under the Senate proposal are designated as Class II but may be redesignated to Class I; under the House proposal, the lands that are designated as Class II but may be redesignated as either Class I or Class III.

The mandatory and discretionary Class I areas as defined by the Senate and House significant deterioration proposals are depicted in Figures 1 and 2.

B. Analysis of Planned Coal Burning Power Plants

In the second approach, a sample of 74 new coal burning power plants representing a total new capacity of 67,000 megawatts was analyzed in order to estimate the expected impact of alternative significant deterioration proposals. The sample of plants was selected from a population of 116,000 megawatts of new coal fired capacity scheduled to be built between 1975 and 1983. The unavailability of data on location, size, and other factors prevented the analysis of a larger sample. However, the coverage and capacity by geographic region is highly significant

Figure 1: ALL MANDATORY AND DISCRETIONARY CLASS I AREAS AS DEFINED BY SENATE PROPOSAL

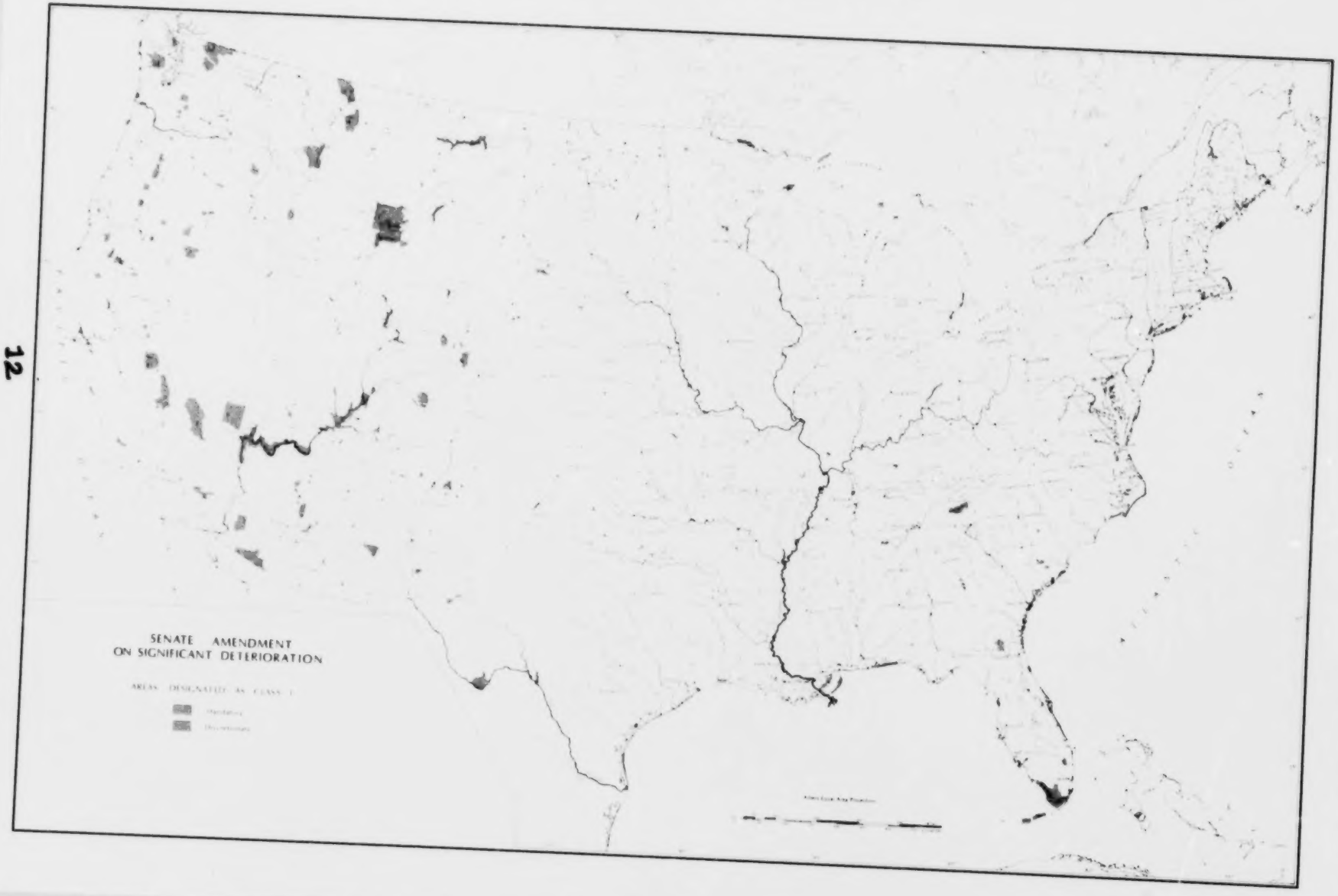
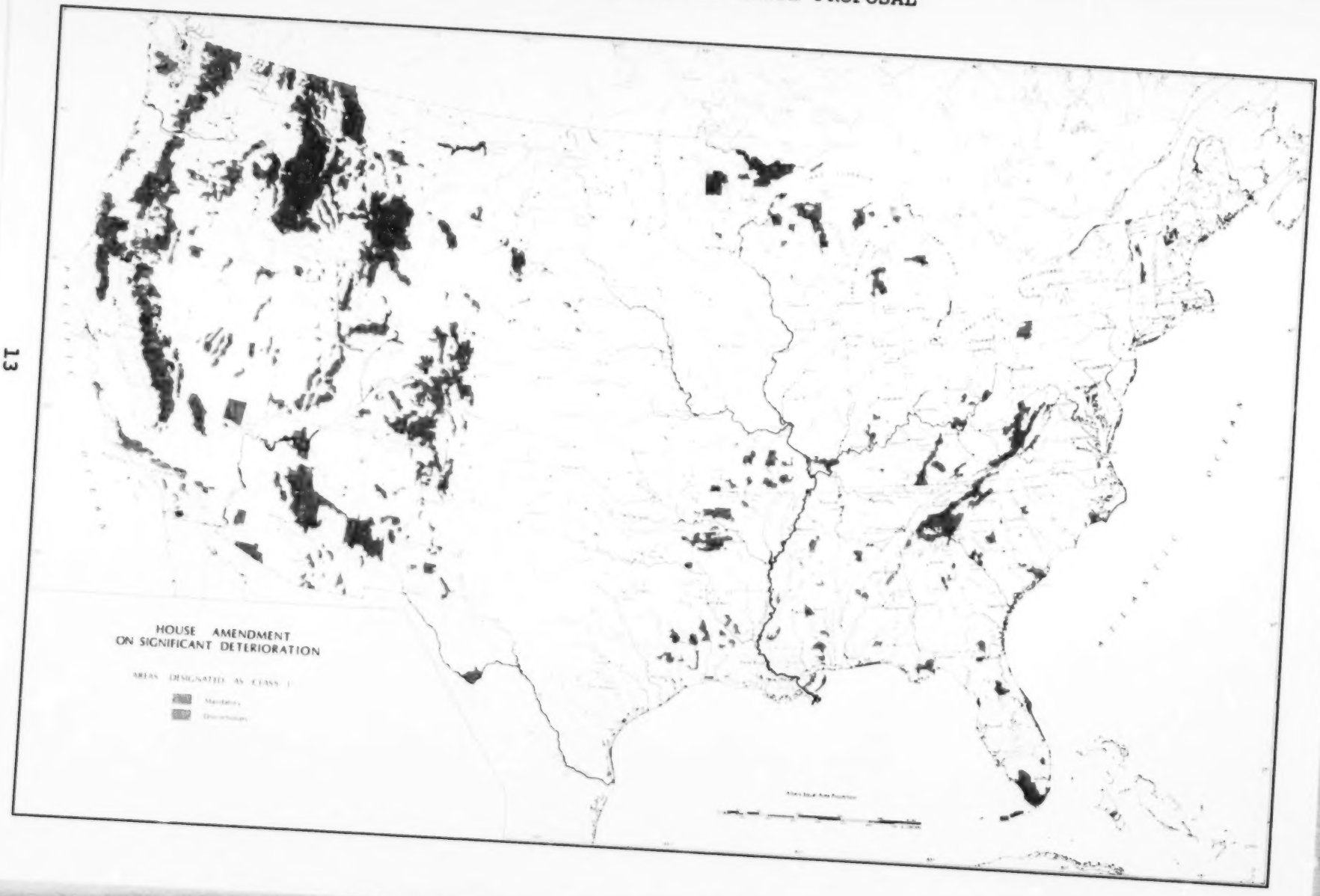


Figure 2: ALL MANDATORY AND DISCRETIONARY CLASS I AREAS AS DEFINED BY HOUSE PROPOSAL



in that data represents 74 percent of planned plant capacity in the East, 52 percent in the midcontinent, and 63 percent in the West. In addition, the plants range in size from 80 to 3,000 megawatts. The location of the 74 plants are shown in Figure 3.

While most of the plants that were studied would not be affected by any significant deterioration requirements because most of the plants commenced construction before the effective date of the regulation,it is believed that the results of this analysis are indicative of the likely impact of alternative significant deterioration proposals on the electric utility industry, if the siting decisions remain static. That is, the analysis assumes that there will be no major changes in the geographic distribution and size of new power plants. It is possible that changes in the geographic distribution and size of new power plants would mitigate many of the impacts quantified in this analysis.

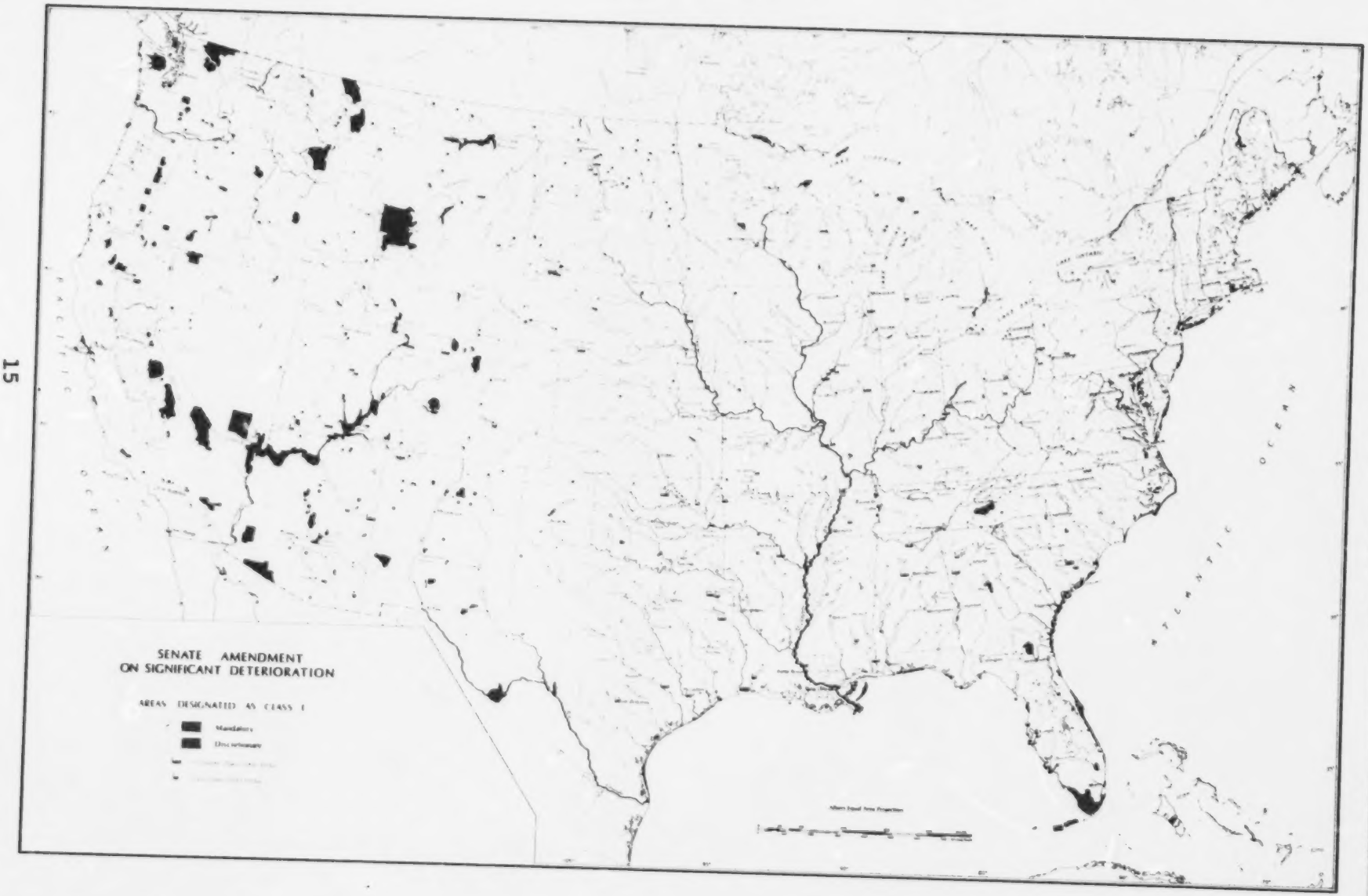
It should be noted that the analysis did not address the economic and energy impacts and associated air quality benefits of changes in the geographic distribution of power plants and/or other control measures (i.e., increased stack height, further control of sulfur dioxide emissions, etc.). However, such analyses are appropriate subjects for further study.

In the absence of an economic cost and air quality benefit analysis that would evaluate the implications of alternative significant deterioration requirements, two indicators of impact have been used to quantify the implications. The two indicators are:

- land area that may be affected, and
- projected power plant capacity that may be affected.

For the purpose of the analysis, "affected" land area or "affected" power plant capacity describes the impact of applicable significant deterioration proposals for any particular set of assumptions concerning the degree of emission control, stack height, and plant size. Furthermore, "affected" land or capacity does not mean that power plant development would be precluded but rather that additional emission control measures would be needed before construction would be permitted.

Figure 3: ALL MANDATORY AND DISCRETIONARY CLASS I AREAS AS DEFINED BY SENATE PROPOSAL, WITH LOCATIONS OF SAMPLE POWER PLANTS



c. Scenarios Studied

The impact of alternative significant deterioration proposals is conveyed herein by the examination of two scenarios that show the range of expected impacts on land area and planned capacity. The two scenarios are:

° High Affected Scenario[1/] This scenario conveys the maximum land area and planned power plant capacity that may be affected.[2/] The scenario assumes:

-- All plants as a minimum meet Federal New Source Performance Standards (NSPS)
-- All discretionary Class I areas are designated Class I (none are redesignated Class II) and all possible Class I areas are designated Class II
-- Allowable stack height is 500 feet
-- All plants must meet both the Class I and II increments (i.e., no Class III)

1/ It should be noted that since the Senate proposal requires best available control technology (BACT), to be determined on a case-by-case basis, in many instances new plants will be required to meet emission limitations more stringent than NSPS. Thus, it is not possible to estimate the impact of the Senate proposal under the High Affected Scenario. However, for analytical purposes, the High Affected Scenario contains an estimate of the impact of the Senate mandatory and discretionary Class I areas assuming that BACT is defined as NSPS.

2/ It should be noted that the "possible" Class I areas have not been included in the High Affected Scenario. When mandatory, discretionary and possible Class I areas are designated, 97% of the land area would be affected assuming all plants are required as a minimum to meet NSPS. Only 67% of the land area would be affected if plants are required as a minimum to meet more stringent emission limitations than required by NSPS. The possible Class I areas are not included in the High Affected Scenario because it was considered unlikely that all possible Class I areas would be designared Class I rather than either Class I or III.

° Low Affected Scenario: This scenario conveys the minimum land area and planned power plant capacity that may be affected. The scenario assumes:

-- All plants as a minimum meet more stringent emission limitations than required by NSPS
-- All discretionary and possible Class I areas are designated as Class II
-- Allowable stack height is 1000 feet under the Senate proposal and 500 feet under the House proposal
-- Some areas may be reclassified as Class III under the House proposal

V. FINDINGS OF THE ANALYSIS

A. Aggregate Impact of the Senate and House Significant Deterioration Requirements on the Electric Utility Industry

The percentage of new coal-fired capacity that may be affected under the High and Low Affected Scenarios is presented in Figure 4. As shown in Figure 4, under the High Affected Scenario, 85% of the capacity may be affected by the House proposal.[1/] Also, under the assumption that Best Available Control Technology (BACT) is defined as Federal New Source Performance Standards (NSPS), 62% of the capacity may be affected by the Senate mandatory and discretionary Class I areas.[2/]

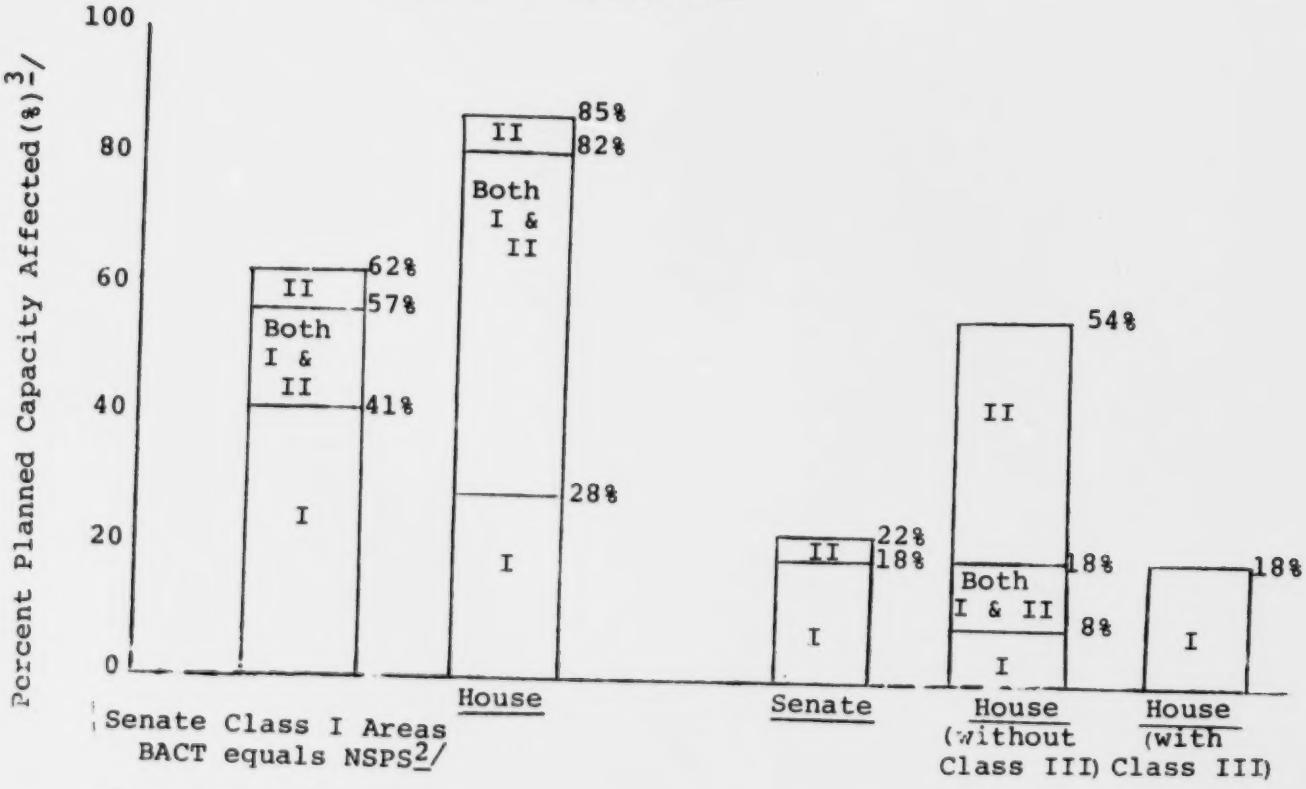
Figure 4 also indicates that if all plants were required at a minimum to meet emission limitations more stringent than NSPS, and if all discretionary and possible Class I areas are designated as Class II (i.e., Low Affected Scenario), the percent of affected capacity under the House proposal would be reduced to 54%. If similar assumptions plus the use of 1000 foot stacks are made for the Senate proposal, 22% of planned capacity would be affected. Finally, if it is further assumed that all Class II areas that restrict plants under the House proposal would be redesignated as Class III, and if background concentrations of sulfur dioxide are assumed to be negligible, the House proposal would only affect 18% of the planned coal-fired capacity.

It can also be concluded from Figure 4 that most of the projected impact under the High Affected Scenario is caused by the designation of Class I areas. For example, 82% of planned capacity under the House proposal would be affected by the mandatory and discretionary Class I provisions.

1/ It is important to note that approximately 16% of the planned capacity under the High Affected Scenario would be constrained by the national ambient air quality standards. However, this capacity would still require additional control in order to comply with the significant deterioration requirements. The cost of the incremental control required can only be properly addressed by an economic analysis.

2/ It should be emphasized that this estimate was made solely for analytical purposes and does not represent the impact of the Senate proposal which defines BACT on a case by case basis and which may in many instances require more stringent control than NSPS.

Figure 4:PLANNED POWER PLANT CAPACITY THAT MAY BE AFFECTED BY THE SENATE AND HOUSE SIGNIFICANT DETERIORATION PROPOSALS[1]



1/It was not possible to quantify the impact of EPA's significant deterioration proposal because the decision to designate Federal lands as Class I areas is at the discretion of State and local governments and/or Federal Land Managers. It should also be noted that affected capacity may be built if additional control measures are employed (i.e., reduced plant size, increased emission control, etc.)

2/This estimate was made solely for analytical purposes and does not represent the impact of the Senate proposal which requires BACT to be determined on a case-by-case basis.

3/I denotes capacity affected only by Class I increments
Both I & II denotes capacity affected by both Class I and Class II increments
II denotes capacity affected only by the Class II increment.

It should be noted that the major impact under the Low Affected Scenario for the House results from the Class II increment (i.e., 46% of a total of 54% of planned capacity). This is caused by the House Class II increment for sulfur dioxide (3-hour increment) which is approximately one-half of the EPA/ Senate Class II increment.

Finally, it should be emphasized that plants which may be affected by the House and Senate significant deterioration proposals could employ additional measures (i.e., relocation at an alternative site, reduced plant size, further control of sulfur dioxide emissions, increased stack height, etc.) in order to comply with the significant deterioration requirements.

B. Implications of Class I Area Designations

1. Land Area Affected

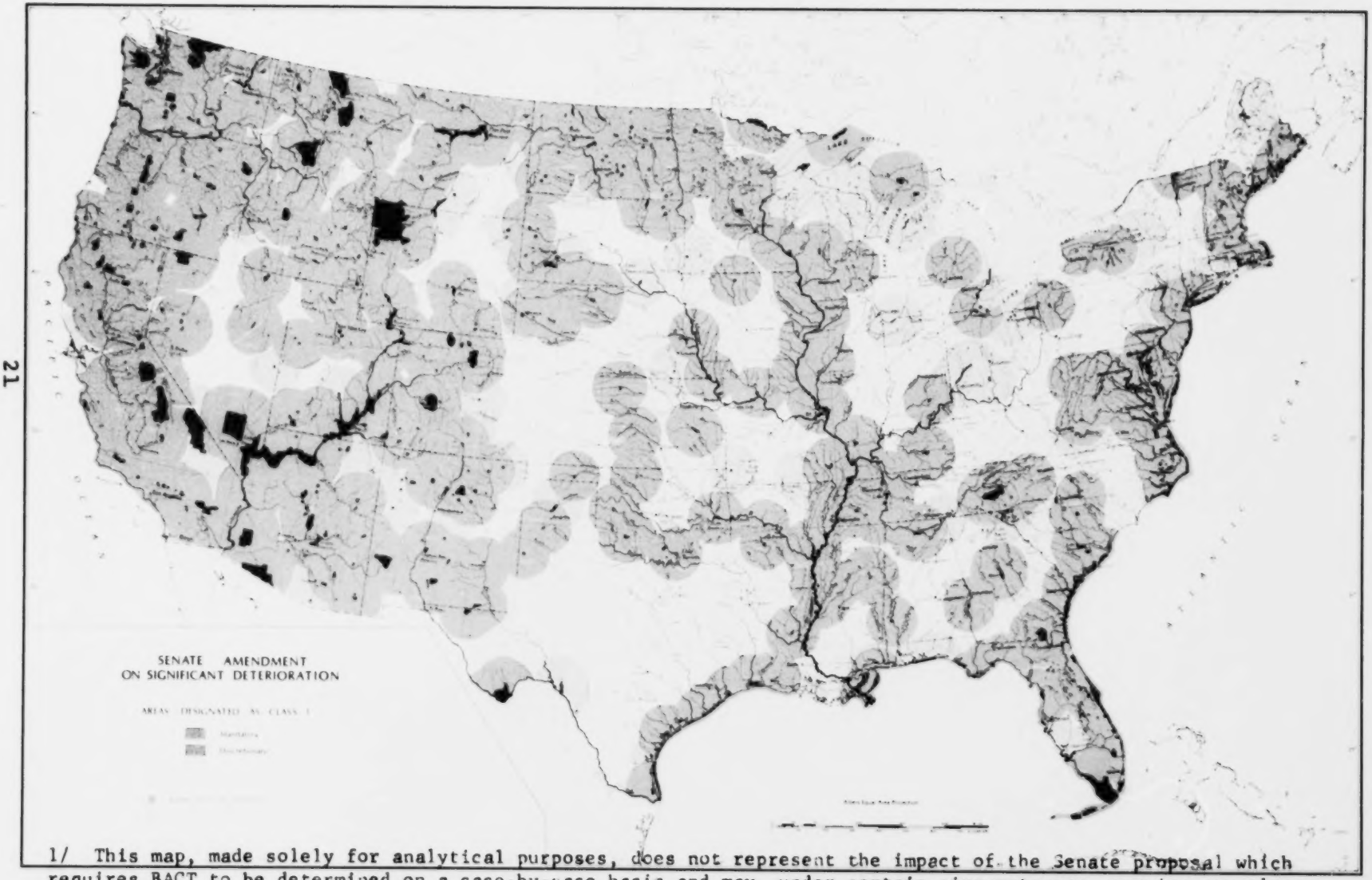
The previous section indicated that the designation of Class I areas has the greatest potential impact on the construction of new coal-fired power plants. The reason why the designation of Class I areas is so important relates to the sizable buffer zones that are necessary in order to insure that pollutants generated by plants located in the vicinity of a Class I area do not violate the Class I air quality increments.

For example, as shown in Figure 5 and in Table 4, 83% of the land area may be precluded by the House mandatory and discretionary Class I areas from the siting of a 1000 MW coal-fired plant meeting NSPS (i.e., High Affected Scenario).1/2/

1/ These estimates assume a 60 mile buffer zone around all mandatory and discretionary Class I areas. This distance was used because accepted meteorological methods indicate that a 1000 MW power plant meeting Federal New Sources Performance Standards (NSPS) could cause a violation in a Class I area as far away as 60 to 100 miles, and is consistent with the preamble to the EPA significant deterioration regulations.

2/ Since there are areas in the country where the sulfur dioxide ambient air quality standard is currently exceeded, the estimates of land area affected provided herein may slightly overstate the likely incremental impact of alternative significant deterioration proposals. However, this overestimate is likely to be minimal for a number of reasons. First, the areas of the country where sulfur dioxide ambient standards are violated are small compared to the estimates of land area affected by the significant deterioration proposals. Secondly, most violations of the sulfure dioxide ambient standard are currently observed in urban areas whereas most new coal-fired power plants are located outside urban areas (see Figure 3 for the location of the 74 coal-fired plants that are planned for the 1975 to 1983 period).

Figure 5: LAND AREAS POSSIBLY PRECLUDED FROM SITING 1000 MW POWER PLANTS, ASSUMING BACT EQUALS NSPS, WITH THE SENATE MANDATORY AND DISCRETIONARY CLASS I AREAS (WITH BUFFER ZONES). 1/



1/ This map, made solely for analytical purposes, does not represent the impact of the Senate proposal which requires BACT to be determined on a case-by-case basis and may, under certain circumstances, require new plants to meet emission limitations more stringent than NSPS.

Also, as indicated in Figure 6, if one assumes that BACT is equal to NSPS, then 75% of the land area may be precluded by the Senate mandatory and discretionary Class I areas from the siting of a 1000 MW power plant. 1/

1/ It should be emphasized that this estimate was made solely for analytical purposes and does not represent the impact of the Senate proposal which requires BACT to be determined on a case-by-case basis and may, under certain circumstances, require new plants to meet emission limitations more stringent than NSPS.

Figure 6: LAND AREAS POSSIBLY PRECLUDED FROM SITING 1000 MW POWER PLANTS, ASSUMING BACT EQUALS NSPS, UNDER THE HOUSE MANDATORY AND DISCRETIONARY CLASS I AREAS (WITH BUFFER ZONES).

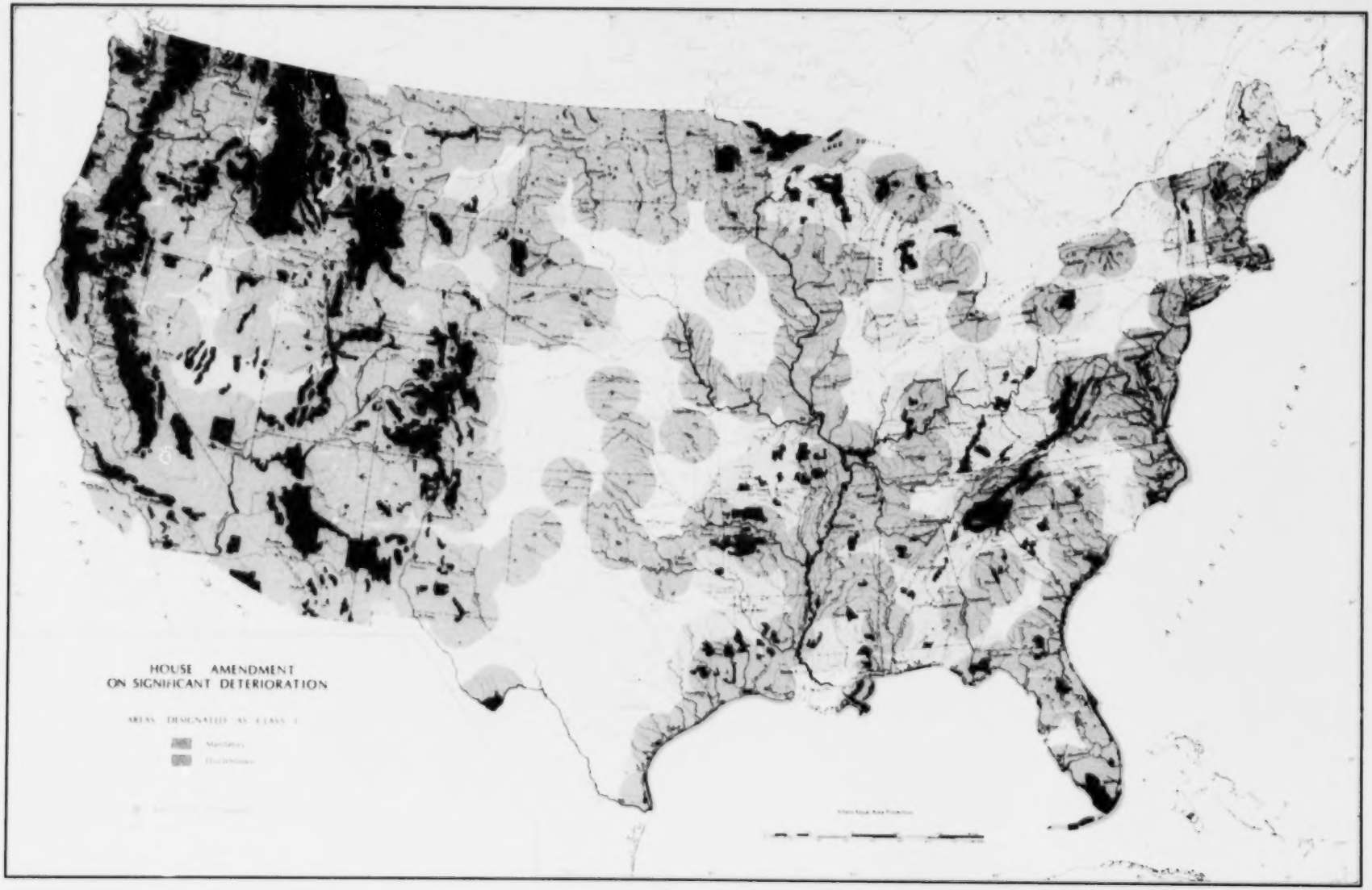


Table 4

SUMMARY OF LAND AREA IN WHICH MANDATORY AND DISCRETIONARY REGIONS, WITH BUFFER ZONES, MAY PRECLUDE THE SITING OF A 1000 MW COAL-FIRED PLANT

Percentage of Land Affected

Region[1]	Senate Class I Areas With BACT Equal to NSPS[2/3]	SENATE BACT Equals NSPS/FGD[4]	HOUSE BACT Equals NSPS[2]	HOUSE BACT Equals NSPS/FGD[4]
West	91%	14%	91%	39%
Mid-West	63	24	72	38
East	72	33	85	47
TOTAL U.S.	75%	22%	83%	40%

If control beyond NSPS is assumed, the land area affected by the mandatory and discretionary designations is reduced to 22% and 40% under the Senate and House proposals, respectively (see Figures 7 and 8).

1/ For purposes of this analysis, the Western region is bounded on the east by the eastern boundaries of the states of Montana, Wyoming, Colorado, and New Mexico; and the Eastern region is bounded on the west by the Western boundaries of the states of Pennsylvania, West Virginia, North Carolina, Georgia, and Florida.

2/ NSPS was assumed to be coal with a sulfur content equal to 1.2 pounds sulfur dioxide per million BTU of heat input.

3/ It also should be emphasized that the Senate proposal requires BACT to be determined on a case-by-case basis and in many instances may require new plants to meet more stringent emission limitations than NSPS. Thus, the estimates in Table 4 of the land impacted by the Senate mandatory and discretionary Class I areas assuming all plants meet NSPS were made soley for analytical purposes and do not represent the impact of the Senate proposal.

4/ NSPS/FGD was assumed to be low sulfur coal (NSPS) plus a scrubber in the West and 3.5% sulfur coal plus a scrubber in other areas.

Figure 7: LAND AREAS POSSIBLY PRECLUDED FROM SITING 1000 MW POWER PLANTS, ASSUMING BACT EQUALS NSPS/FGD, WITH THE SENATE MANDATORY AND DISCRETIONARY CLASS I AREAS (WITH BUFFER ZONES).

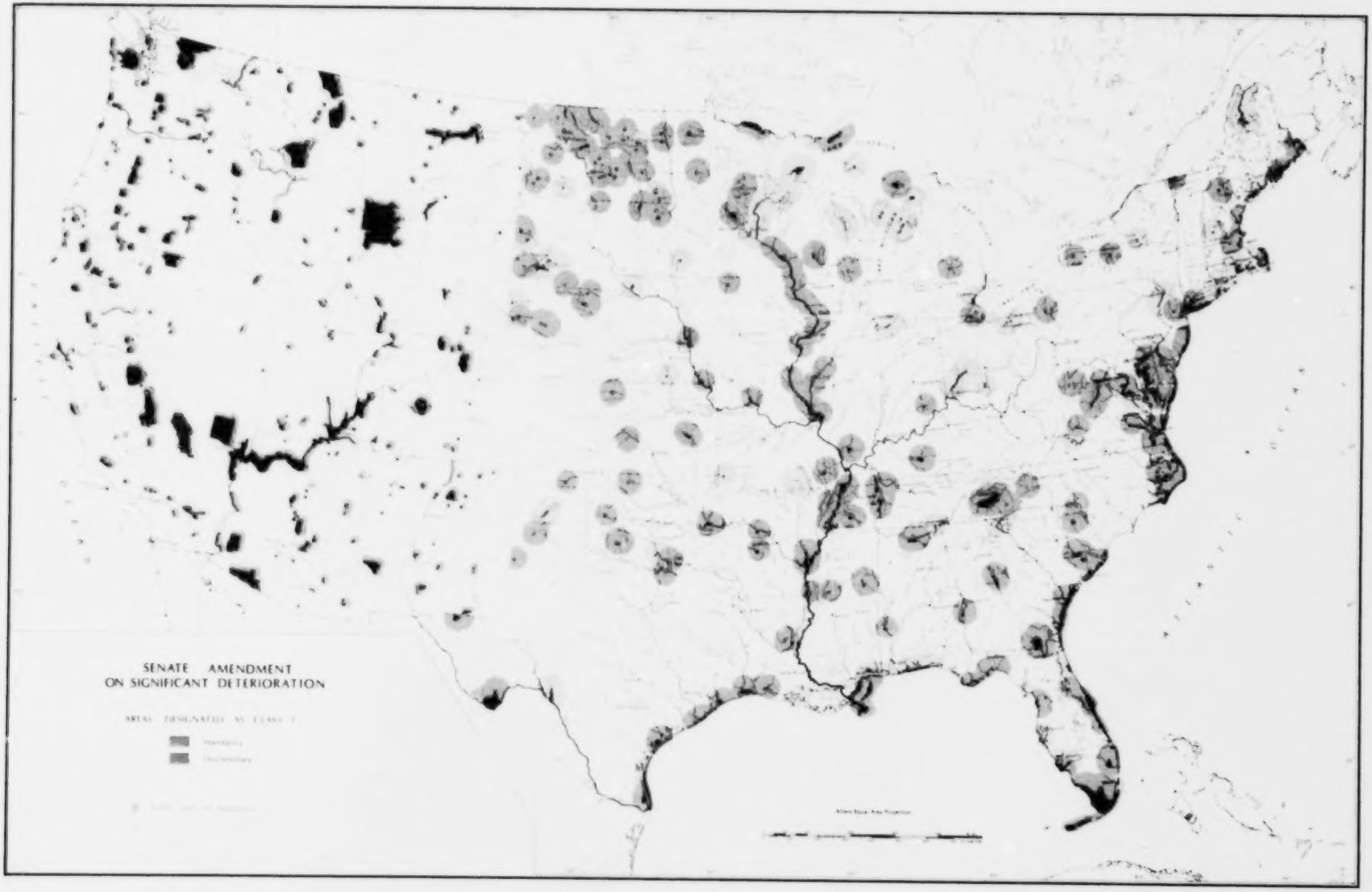
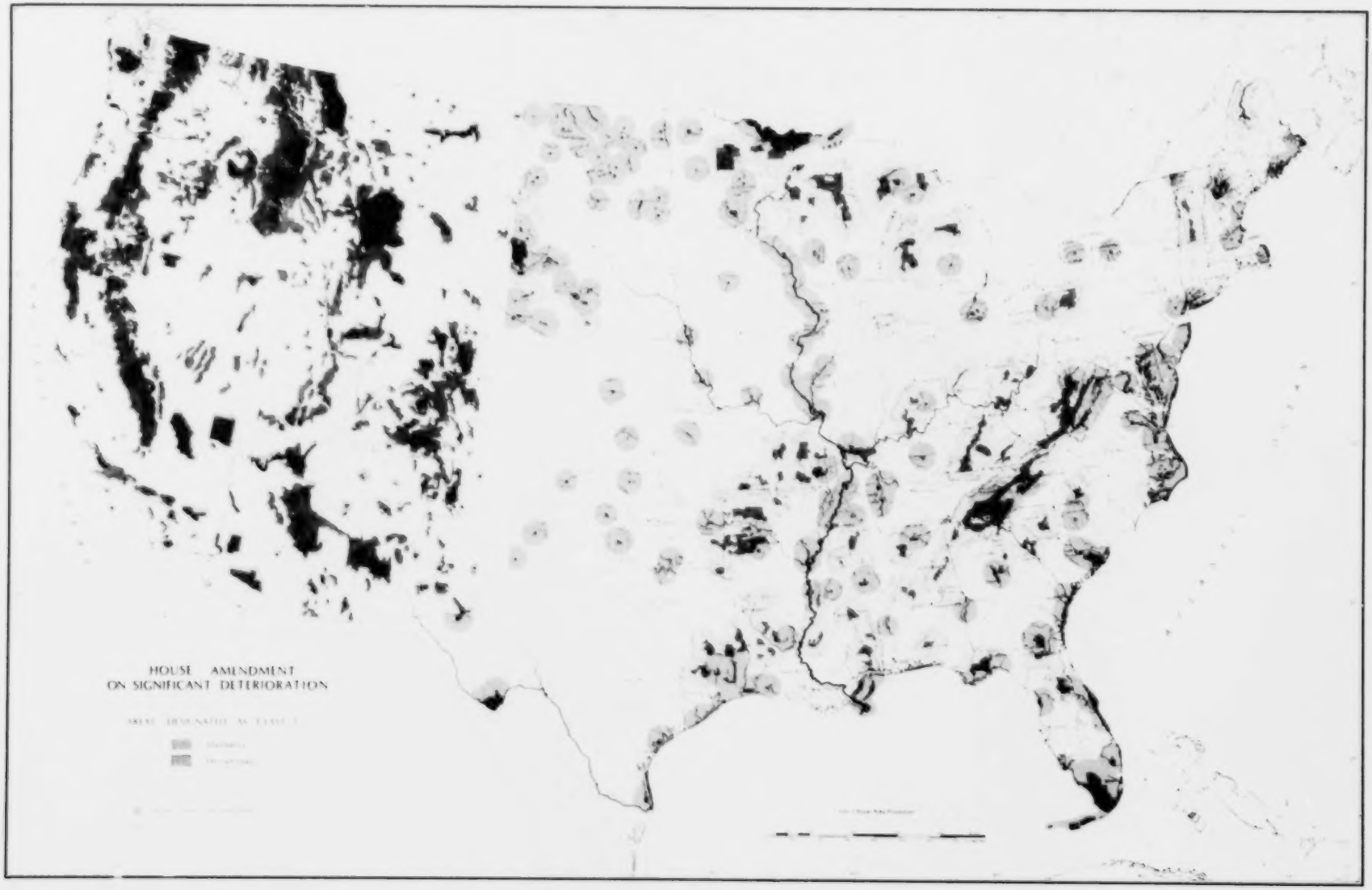


Figure 8: LAND AREAS POSSIBLY PRECLUDED FROM SITING 1000 MW POWER PLANTS, ASSUMING BACT EQUALS NSPS/FGD, UNDER THE HOUSE MANDATORY AND DISCRETIONARY CLASS I AREAS (WITH BUFFER ZONES).



The impact of designating all discretionary Class I areas as Class II and requiring new plants to meet emission limitations more stringent than NSPS (i.e., Low Affected Scenario) is illustrated in Figures 9 and 10 for the Senate and House proposals respectively. As indicated in Table 5, 16% of the land area under the Senate and 17% of the land area the House proposal may be precluded from the siting of 1000 MW power plants with additional controls.[1/]

Table 5

SUMMARY OF LAND AREA IN WHICH MANDATORY CLASS I REGIONS, WITH BUFFER ZONES, MAY PRECLUDE THE SITING OF A 1000 MW COAL-FIRED PLANT

Percentage of Land Affected

Region	Senate Class I Areas; BACT Equals NSPS[2/]	SENATE BACT Equals NSPS/FGD	HOUSE BACT Equals NSPS	HOUSE BACT Equals NSPS/FGD
West	82%	10%	89%	11%
Mid-West	52	18	54	19
East	57	24	59	24
TOTAL U.S.	65%	16%	68%	17%

If new power plants are as a minimum only required to meet NSPS, the land area affected by the Senate mandatory Class I designation increases to 65%[2/] and the area affected by the House mandatory Class I designation increases to 68% (see Figures 11 and 12).

1/ These estimates assume a 6 mile buffer zone around all Class I areas in the West and a 27 mile buffer zone around Class I areas in the East and mid-West. The buffer zones assume that a 1000 MW plant in the West would use a scrubber in conjunction with low sulfur coal (i.e., control to 10% of NSPS) and plants in all the areas would burn 3.5% coal along with a scrubber (i.e., control to 50% of NSPS). Although this assumption for the East does not take into account the availability of lower sulfur coal or the use of coal washing, the assumption does reflect readily available coal and the assumption of a scrubber achieving 90% removal efficiency with 100% availability.

2/ These estimates were made solely for analytical purposes and do not represent the impact of the Senate proposal.

Figure 9: LAND AREAS POSSIBLY PRECLUDED FROM SITING 1000 MW POWER PLANTS, ASSUMING BACT EQUALS NSPS/FGD, WITH THE SENATE MANDATORY CLASS I AREAS (WITH BUFFER ZONES).

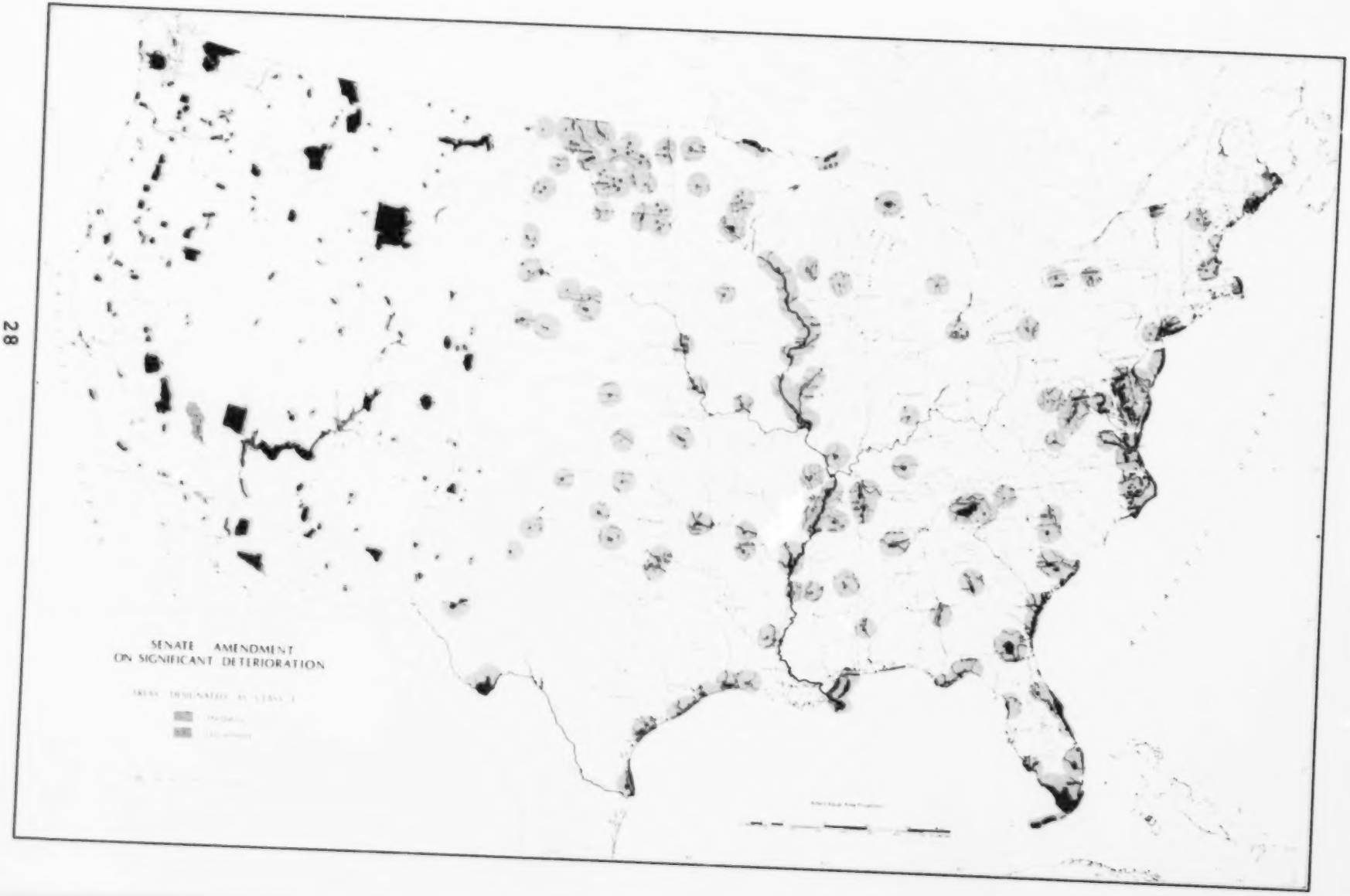


Figure 10: LAND AREAS POSSIBLY PRECLUDED FROM SITING 1000 MW POWER PLANTS, ASSUMING BACT EQUALS NSPS/FGD, UNDER THE HOUSE MANDATORY CLASS I AREAS (WITH BUFFER ZONES).

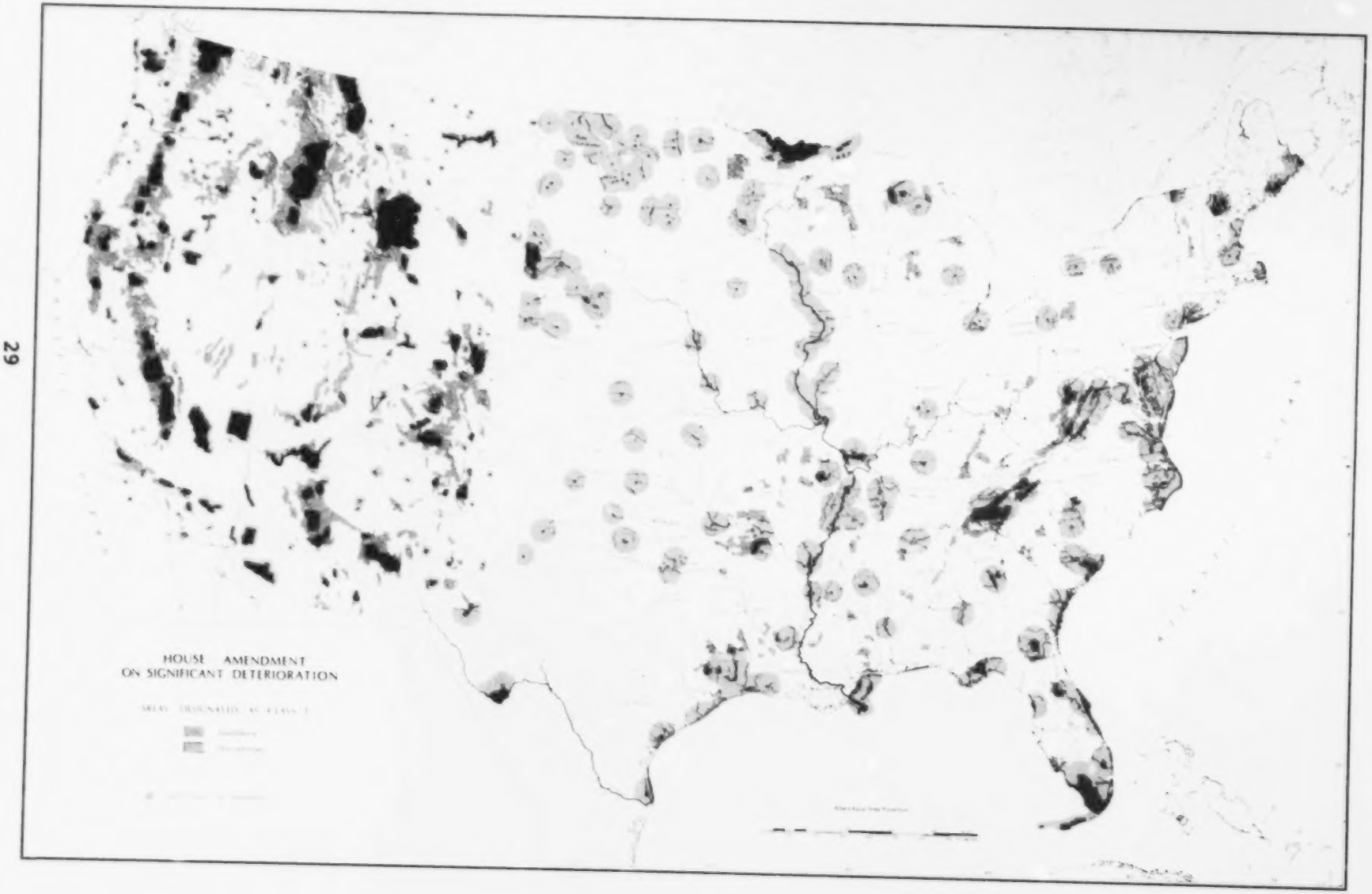
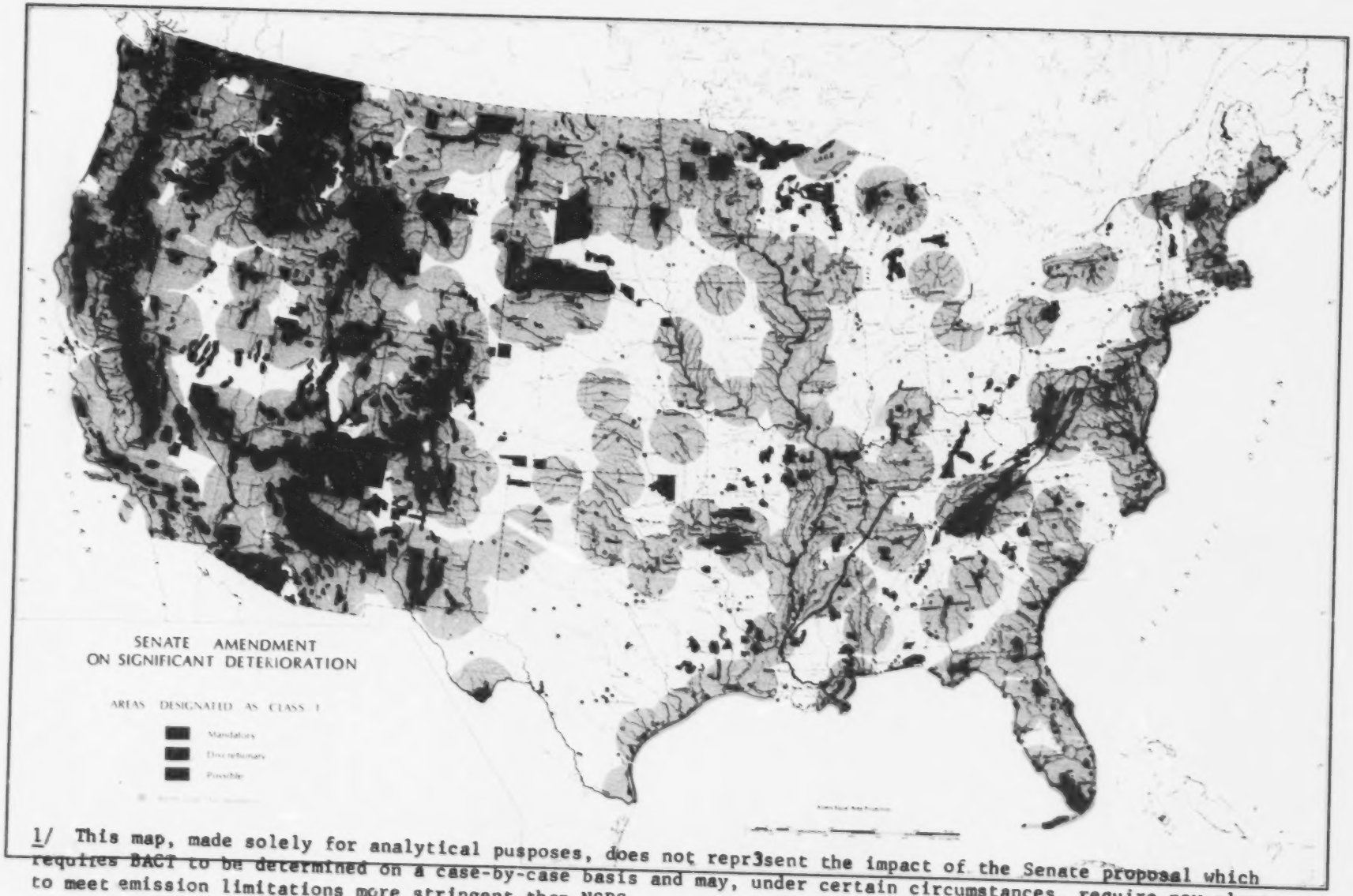
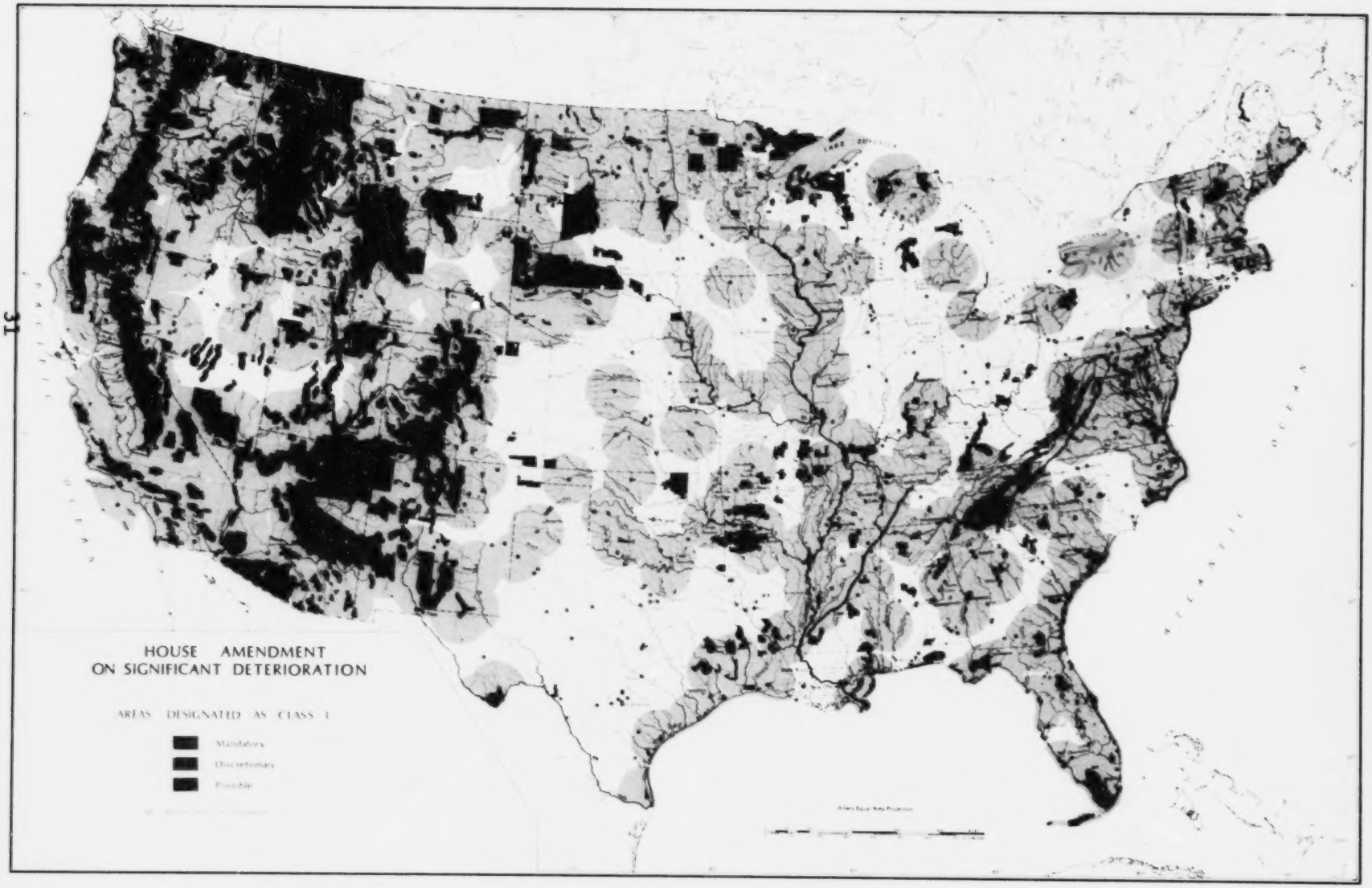


Figure 11: LAND AREAS POSSIBLY PRECLUDED FROM SITING 1000 MW POWER PLANTS, ASSUMING BACT EQUALS NSPS, WITH THE SENATE MANDATORY CLASS I AREAS (WITH BUFFER ZONES).



1/ This map, made solely for analytical pusposes, does not repr3sent the impact of the Senate proposal which requires BACT to be determined on a case-by-case basis and may, under certain circumstances, require new plants to meet emission limitations more stringent than NSPS.

Figure 12: LAND AREAS POSSIBLY PRECLUDED FROM SITING 1000 MW POWER PLANTS, ASSUMING BACT EQUALS NSPS, UNDER THE HOUSE MANDATORY CLASS I AREAS (WITH BUFFER ZONES).



It should be noted that the extent of land area affected by the mandatory Class I designations with buffer zones is substantially greater than the land covered by the mandatory Class I areas which is approximately 2% of the continental U.S. land area (see Table 6).

Table 6

LAND AREA COVERED BY THE MANDATORY CLASS I AREAS

	Number of Sites	Area of Land Covered (Million Acres)	% of Continental U.S. Land Area
Senate Version	362	33	1.7%
House Version	414	42	2.2%

Also note in Table 6 that approximately 400 sites are designated as mandatory Class I under the Senate and House proposals. Because of the associated buffer zones, the number of potential Class I designations is the major public policy issue.

It is also important to note that the geographic impacts of mandatory Class I areas on power plant siting is not uniform. For example, under the High Affected Scenario for the House proposal, the impact is mose severe in the West where more than 80% of the land area may be precluded from the siting of a 1000 MW power plant meeting NSPS. On the other hand, the use of low sulfur coal and scrubbers would reduce the affected land area in the West to 10%. By contrast, under the Low Affected Scenario, the impact is most severe in the East where about 25% of the land area may be affected.

Finally, because proximity of a power plant to cooling water is essential for the siting of the facility, an analysis was made of the impact of mandatory and/or discretionary Class I areas on the siting of new plants along the coast or in major water resource regions. As in the preceding analysis, the results varied according to the number of Class I areas included and the degree of pollution control assumed. For example, for the case where all plants meet NSPS as a minimum, mandatory and discretionary Class I areas may preclude about 95% of the coastline from the siting of a 1000 MW power plant. However, if plants are required to meet more stringent emission limitations than NSPS, the percentage of the coastline which may be precluded is reduced to

70% under the Senate proposal and 64% under the House proposal. In addition, if it is assumed that all discretionary Class I areas are redesignated Class II, the percentage of coastline that may be excluded is further reduced to about 50% under both the Senate and House proposals. This number is only reduced to 50% using both the Senate and House mandatory Class I areas because of the significant number of National Wildlife Refuges in these coastal areas, which account for roughly two thirds of the total number of Class I areas specified in the Senate and House proposals.

2. Power Plant Capacity Affected

Since the preceding analysis did not consider the affect of mandatory and discretionary Class I areas on plants larger or smaller than 1000 MW, the impact on a sample of new coal-fired power plants that are planned to be built between 1975 and 1983 was analyzed. In this analysis, a buffer zone was calculated for each power plant in the sample based on the planned plant size and on the degree of pollution control that is assumed. The results using this procedure are presented in Table 7.

Table 7

PLANNED CAPACITY WHICH MAY BE AFFECTED BY MANDATORY AND/OR DISCRETIONARY CLASS I AREAS

Class I Areas	Senate Class I Areas; BACT equals NSPS 1/ 2/	SENATE BACT Equals NSPS/FGD	HOUSE BACT Equals NSPS 2/	HOUSE BACT Equals NSPS/FGD
Mandatory Areas Only	50%	18%	60%	18%
Mandatory and Discretionary Areas	57%	24%	82%	45%

1/ These estimates were made solely for analytical purposes and do not represent the impact of the Senate proposal which requires BACT to be determined on a case-by-case basis and will, therefore, require new plants, in many instances, to meet emission limitations more stringent than NSPS.

2/ It should be noted that if new plants are required as a minimum to meet NSPS, 16% of planned capacity would need to employ additional control measures in order to meet national ambient air quality standards. However, additional control measures would still be needed to meet significant deterioration requirements.

As indicated in Table 7, the percentage of capacity that may be affected by the Class I provisions depends upon the number of areas which are designated Class I and on the degree of pollution control assumed. For example, for the case that all plants are required as a minimum to meet NSPS, the House mandatory and discretionary Class I areas may affect 82% of planned capacity. However, if all new plants are required, as a minimum, to meet emission limitations more stringent than NSPS, the mandatory and discretionary Class I areas may affect only 24% of planned capacity under the Senate proposal and 45% under the House proposal. If it is further assumed that all discretionary Class I areas are redesignated as Class II (i.e., only mandatory Class I areas), the percentage of affected capacity falls to 18% under both the Senate and House proposals.

Finally, it should be emphasized that new coal-fired plants which may be affected by the Class I provisions could employ additional measures (i.e., relocation at an alternative site, reduced plant size, further control of sulfur dioxide emissions, increased stack height, etc.) in order to comply with the House and Senate proposals.

C. Impact of Alternative Class II Increments

1. Size Limitations Imposed by Class II Increments

The actual size of new coal-fired power plants which could be constructed under alternative Class II increments is dependent upon a variety of site specific characteristics. Among these are the size of the plant, the surrounding terrain, meteorological conditions (i.e., prevailing wind directions, inversion layers), the degree of emissions control and the sulfur content of the coal burned. However, for the purposes of this analysis, actual meteorological data from three areas of the U.S. were used to simulate varying meterological conditions around the country. In addition, two different diffusion models were used in order to fully evaluate the effect of terrain on a power plant's size which could meet alternative Class II increments.[1/]

1/ EPA's "CRSTER" model was used to estimate the maximum size plant which could be built for cases where the top of the plant's stack was not higher than the surrounding terrain. EPA's "Valley" model was used to calculate maximum plant size for those cases where the surrounding terrain was at least 500 feet higher than the plant's stack. Detailed explanations of the theory and methodology employed are given in Appendices B and C of Volume II, Technical Support Document.

The results of this analysis indicate that if the surrounding terrain is at or below the top of the plant's stack, both the EPA/Senate and the House Class II increments would allow the siting of a 1000 MW power plant that meets New Source Performance Standards by the use of low sulfur coal.

The analysis also indicates that plants considerably greater than 1000 MW could be built if a scrubber was used in conjunction with low sulfur coal. However, the modeling results show that a 1000 MW power plant burning 3.5% coal and using a 90% efficient (100% reliable) scrubber would not comply with the EPA/Senate and House Class II increments if the surrounding terrain were above the top of the stack. This is due to the decreased plume rise caused by the scrubber, which becomes more significant as nearby terrain approaches the height of the stack.

It should be emphasized, however, that a 1000 MW plant located in such terrain could comply with any of the proposed Class II increments if the stack height were increased by approximately 250 feet, or if coal with a sulfur content of approximately 1.8% was burned in combination with a 90% efficient (100% available) scrubber.

The results of the analysis for the case where the surrounding terrain at or beyond 15 miles is at least 500 feet above the plant's stack indicate that a 1000 MW plant meeting NSPS could meet the EPA/Senate Class II increment but not the House Class II increment.

If the surrounding terrain within 12 miles is at least 500 feet above the plant's stack, then a 1000 MW power plant meeting NSPS would not meet either the EPA/Senate or House Class II increments. However, as in the previous analysis, when control beyond NSPS is assumed, the alternative Class II increments are less restrictive. Specifically, if a scrubber was used with high sulfur coal, a 1000 MW plant could be built under the House Class II increment unless the surrounding terrain within 9 to 12 miles was at least 500 feet higher than the plant's stack. Since the EPA/Senate increment is less restrictive, the dominant terrain feature could be as close as 9 miles. If a scrubber was used with low sulfur coal, a 1000 MW plant could be built under either the EPA/Senate or House Class II increments as long as the terrain within 3 miles was not 500 feet higher than the plant's stack.

Finally, it should be noted that since the House Class II increment for sulfur dioxide is more restrictive than the EPA/Senate Class II increment, larger plants could be built under the EPA/Senate Class II increment. Specifically, depending on local terrain and meteorological conditions, new power plants may be 10% to 100% larger under the EPA/Senate Class II increments than under the House Class II increment.

2. Impact of Class II Increments on Planned Coal-Fired Power Plants

The results of the modeling analysis described in the previous section were used to examine the implications of alternative Class II increments on the sample of 74 new coal-fired power plants. The results of this analysis are presented in Table 8.

TABLE 8

PLANNED CAPACITY WHICH MAY NOT COMPLY WITH ALTERNATIVE CLASS II INCREMENTS[1/]

Degree of Pollution Control	EPA	SENATE	HOUSE
-NSPS[2/]			
- % of Sample Plants	18%	18% [4/]	39%
- % of Sample Capacity	21%	21% [4/]	57%
-NSPS/FGD[3/]			
- % of Sample Plants	5%	5%	20%
- % of Sample Capacity	10%	10%	47%

1/ Estimates are based on the use of 500 foot stacks

2/ Assumes plants meet NSPS by use of low sulfur coal (1.2 lbs. sulfur dioxide per million BTU heat input).

3/ Assumes plants in the West use a scrubber in conjunction with low sulfur coal (i.e., control to 10% of NSPS), and plants in the East and Mid-west would burn 3.5% coal along with a scrubber (i.e., control to 50% of NSPS). Although this assumption for the East and Mid-west does not take into account the availability of lower sulfur coal or the use of coal washing, the assumption does reflect readily available coal and the assumption of a scrubber achieving 90% removal efficiency with 100% availability.

4/ It should be emphasized that this estimate was made solely for analytical purposes and does not represent the impact of the Senate proposal which requires BACT to be determined on a case-by-case basis and may, under certain circumstances, require new plants to meet emission limitations more stringent than NSPS.

Table 8 indicates that if all plants meet NSPS, about 18% of the plants and 21% of planned capacity may not comply with the EPA/Class II increment. The comparable figures for the House Class II increment are 39% of the plants and 57% of planned capacity. It should be noted that the House Class II increment has more of an impact on new plants because the House's 3-hour increment is only 50% of the EPA/3-hour increment.

Table 8 also indicates that control beyond NSPS will have a greater impact on the number of plants that can comply with the EPA/Class II increment. Specifically, the affected percentage of the sample plants will be reduced to 5% and the percentage of planned capacity to 10%. The comparable figures for the House proposal are 26% of sample plants and 47% of planned capacity. As in the previous example, the differential impact of more stringent pollution control is caused by the House's tighter Class II increment.

It should be noted that the geographic distribution of impacted plants as a result of the Class II increment is not uniform. While the EPA/Class II increment may have a slight impact on eastern and Mid-west plants, assuming New Source Performance Standards are met, approximately 80% of the western plants could be impacted. The House version has a greater impact on the non-western areas possibly impacting one-third of the eastern plantsand one-fourth of those planned for the Mid-west. If plants were required to meet emission limitations more stringent than NSPS, the potential impact under all the proposals on the plants in the East and Mid-west would be negligible. However, even with low sulfur coal and scrubbers, the House or Senate Class II increments may affect the construction of 20% of the planned plants in the West.

3. Limitations Imposed on New Coal-Fired Plants by Class III Increments.

Under the Senate proposal, the plants identified in Table 8 could not comply with significant deterioration regulations unless they employed one or more of the mitigating measures discussed in the previous section. However, under the EPA and House proposals these plants might comply if the area in the vicinity of the plant is redesignated as Class III. The analysis indicates that if all plants met as minimum NSPS, only 16% of planned capacity may not comply with EPA's Class III increment which is equivalent to the national ambient air quality standards. It should be emphasized that

this impact would exist even if there were no significant deterioration requirements. However, the significant deterioration regulations would require these plants to control beyond ambient air quality standards in order to comply with the EPA/Senate Class I or II increments.

It should be noted that an additional 2% (i.e., a total of 18%) of planned capacity would be restricted by the House Class III increment which is 50% of the national ambient air quality standards. It is also important to note, however, that if control beyond NSPS is required, all of the planned capacity could comply with the EPA or the House Class III increments.

D. Implications of Stack Height Requirements

Table 9 illustrates the effectiveness of increasing stack height.

TABLE 9

EFFECTS OF STACK HEIGHT DIFFERENTIALS ON THE NUMBER OF PLANTS WHICH MAY NOT COMPLY WITH ALTERNATIVE CLASS II INCREMENTS[1/]

	ALLOWABLE STACK HEIGHT	
	500' Stack	1000' Stack
EPA/Senate Class II		
- % of Sample Plants	5%	3%
- % Sample Capacity	10%	4%
House Class II		
- % of Sample Plants	26%	14%
- % Sample Capacity	47%	28%

1/ Assumes that BACT requires all plants to meet emission limitations more stringent than NSPS (i.e., 10% of NSPS in the West and 50% of NSPS in the East and Mid-west).

As indicated in the Table 9, increasing the allowable stack height from 500 to 1000 feet will reduce the number of plants affected by the Class II increment. This is because an increase in stack height decreases the possibility of having the plant's plume impact on surrounding terrain.

Specifically, the capacity affected by the EPA/Senate Class II increment is reduced from 10 to 4%. By comparison, the capacity affected by the House Class II increment is reduced from 47 to 28%, which is equivalent to a reduction of 40%. It is worth noting, however, that this potential 40% reduction in affected capacity would not be allowed under the current House proposal due to the proposed stack height limitation of approximately 500 feet.

E. Minimum Level of Emission Control

EPA's regulations require new plants as a minimum to install Best Available Control Technology (BACT) and define BACT as Federal New Source Performance Standards (NSPS) or State requirements where they are more stringent than NSPS. The Senate proposal, however, requires the determination of BACT on a case by case basis which may result in situations where plants are required to meet emission limitations more stringent than NSPS. As was previously discussed, the definition of BACT is only an issue in situations where more emission control may be required than needed to meet the significant deterioration provisions, (i.e., Class I, II, or III increments).

The analysis shows that a definition of BACT as provided in the Senate's proposal[1/] may result in more control than needed to comply with alternative significant deterioration requirements. Specifically, as indicated in Table 10, under the High Affected Scenario, 38% of the planned capacity could comply with the Senate Class I and II requirements by meeting NSPS. Accordingly, the Senate

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1/ This paper assumed that the Senate's definition of BACT would be implemented by the States as follows:

- one-tenth NSPS in the West (i.e., low sulfur coal with a scrubber), and
- one-half NSPS in the East and Midcontinent (i.e., 3.5% sulfur coal with a scrubber).

definition of BACT (i.e., NSPS/FGD) may require 38% of planned capacity to meet more stringent emission limitations than needed to comply with the Senate significant deterioration Class I or Class II increments.

Table 10

PLANNED CAPACITY WHICH MAY BE REQUIRED TO MEET MORE STRINGENT EMISSIONS LIMITATIONS THAN NECESSARY TO MEET THE SENATE AND HOUSE SIGNIFICANT DETERIORATION INCREMENTS

Scenario	Senate Class I Areas; BACT Equals NSPS	SENATE BACT Equals NSPS/FGD	HOUSE BACT Equals NSPS	HOUSE BACT Equals NSPS/FGD
• High Affected Scenario	38%	N/A	15%	N/A
• Low Affected Scenario	N/A	78%	N/A	46-82%

Similarly, Table 10 shows that under the High Affected Scenario, 15% of the planned capacity could comply with the House Class I and II increments by meeting NSPS. Thus, if the House were to adopt the Senate definition of BACT,[1/] 15% of planned cacacity would be required meet more stringent emission limitations than required to comply with the House significant deterioration requirements.

Table 10 also indicates that under the Low Affected Scenario, a maximum of 78% of planned capacity[2/] may be able to comply with the Senate significant deterioration proposal by meeting less stringent emission limitations than required by the Senate definition of BACT (i.e., 10% of NSPS in the West and 50% NSPS in the East and mid-west). Similarly, under the Low Affected Scenario, a maximum of 46 to 82% of planned capacity[1/]

1/ It should be noted that the House proposal,as currently written, does not address the issue of BACT.

2/ An undetermined amount of capacity may have to control exactly to the Senate definition of BACT in order to comply with the Senate or House significant deterioration requirements.

may be able to comply with the House significant deterioration proposals by meeting less stringent emission limitations than would be required if the House adopted the Senate definition of BACT.

Accordingly, as the analysis indicates, the Senate definition of BACT may require a level of emission control that is greater than the level of control necessary to meet significant deterioration requirements. The level of excess emission control depends significantly on the number of Class I areas that may be designated and the allowable stack height. 1/

However, it should be noted that the Senate definition of BACT would result in lower levels of emissions than a definition of BACT which only required new plants as a minimum to meet NSPS. The Senate definition would also allow more flexability for future growth and expansion of other sources in the area surrounding the power plant.

1/ It should be noted that under the High Affected Scenario, allowable stack height for both the Senate and House proposals is 500 feet while under the Low Affected Scenario, allowable stack height for the Senate proposal is 1000 feet.

VI. LIMITATIONS OF THE STUDY

This study was intended to serve as a first effort to estimate the impact of alternative approaches to significant deterioration on the electric utility industry and to identify areas recommended for further detailed analysis. As such, the approach taken herein has certain drawbacks which tend to either overstate or understate the actual impact of alternative significant deterioration policies:

- The analysis is based on a sample of power plants that were planned before the effective date of the significant deterioration requirements. Accordingly, the analysis did not address the feasibility of changing the geographic and size distribution of new power plants based on compliance with alternative significant deterioration requirements.

- The value of preventing the significant deterioration of air quality was not addressed. Although it is difficult to quantify the benefits of preventing air quality from degrading up to the secondary ambient air quality standards, this issue should be addressed in order to fully evaluate the implications of alternative significant deterioration proposals.

- Estimates were not provided of the economic impact of alternative significant deterioration policies on the electric utility industry and on the consumers of electricity. Plants which would be potentially impacted by the significant deterioration regulations could choose between several alternative means of complying with the regulations: relocate at another site with more favorable terrain and meteorological conditions; reduce the planned plant size; reduce sulfur oxide emissions further; and increase the height of the stack. However, due to time limitations it was not possible to quantify the economic impact that would result from the use of these measures. Such an analysis is necessary in order to evaluate the implications of alternative significant deterioration proposals.

- The impact on the generating efficiency of new coal-fired power plants resulting from the possibility of smaller plants, energy penalties associated with scrubber use, alternative site locations and delayed phase-out of old plants has not been assessed. Furthermore, environmental concerns associated with the need to site a greater number of smaller plants, dispose of scrubber by-products and possible resistance to the further designation of Federally protected lands (i.e., potential Class I areas) have not been quantified. Finally, the implications on the development of domestic coal resources and rate of nuclear power plant development needs to be examined.

VII. Recommendations for Further Study

Based on the results of this preliminary assessment of alternative significant deterioration proposals, it appears that additional work would be useful to further refine the analysis. The principal areas of possible future work are summarized below:

1. The economic impact of alternative approaches to significant deterioration on the electric utility industry and on the consumers of electricity should be ascertained. The analysis should include, but not be limited to, an estimation of the cost of the options available to potentially impacted plants;

   - o Alternative siting arrangements
   - o Reduced facility size
   - o Increased sulfur dioxide control
   - o Increased stack height

   Such an analysis should also include an assessment of the benefits that would result from the prevention of significant deterioration of air quality.

2. The analysis should be expanded to include the impact of alternative significant deterioration approaches on other major energy facilities such as:

   - o Petroleum refineries
   - o Synthetic fuel plants (i.e., gasification, liquefaction)
   - o Oil shale facilities

3. The implications of a significant deterioration requirement on national and regional projections for coal and nuclear electric facilities should be explored.

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